

UNITED STATES PATENT APPLICATION

of

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for

**SYSTEM AND METHOD FOR INTERCONNECTING COMPONENTS
THAT EMPLOY EITHER COMPOSITE OR S-VIDEO SIGNALS**

UNITED STATES PATENT AND TRADEMARK OFFICE

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1 traditional broadcast antennas provide reception of video programming. Home theater
2 systems provide stereo and near theater quality audio. Internet terminals, such as WebTV®
3 boxes developed by WebTV Networks, Inc., of Palo Alto, California, allow consumers to
4 connect to the Internet and to send and receive information, using a television as the display
5 device. Using the foregoing consumer electronic devices or others in combination with a
6 television, consumers can now select and configure a wide variety of home entertainment
7 systems.

8 Although many consumer electronic devices are available, connecting and using
9 multiple devices in a home entertainment system can be extremely difficult and frustrating,
10 particularly when the devices employ different signaling formats. The interconnection is
11 further complicated because each of the various signaling formats requires its own type of
12 connectors, such as RCA-type connectors, S-video connectors, and so forth. The connectors
13 have traditionally connected the devices within a home entertainment system through the
14 use of either a cable with RCA-type connectors attached or a cable with S-video connectors
15 on both ends. The interconnection becomes complicated when a user desires to connect
16 devices where one device has RCA-type connectors for transmitting composite signals, and
17 the other device has an S-video connector for transmitting S-video signals.

18 It would, therefore, be an advancement in the art to simplify the method of
19 connecting consumer electronic devices within a home entertainment system. It would also
20 be an advancement in the art to provide a technique that would allow for the transmission of
21 either composite or S-video signaling on the same connecting device. Further, it would be
22 an advancement in the art if the connecting device could work with all types of consumer
23 electronic devices. Such advancements would increase the ease of use of consumer
24 electronic devices and would enable users to experience the full functionality of the devices.

SUMMARY OF THE INVENTION

The present invention relates to systems and methods for use in inter-device connectivity within an entertainment system that allow for switching between composite video and S-video formats. More specifically, the systems and methods support left audio, right audio, and can be selectively adapted to support either composite video or S-video. The systems and methods provide increased ease and flexibility, and improved interoperability of components within an entertainment system.

In one implementation of the invention, a system includes a cable with a left audio connector, a right audio connector, a male S-video connector and a mini plug. An adapter that has a male RCA end and a female S-video end is available for mating with the male S-video connector of the cable to allow for selective switching between S-video and composite video by employing a two-pin shortage. Thus, through the use of the adapter, the connector system is compatible with both the S-video and composite video formats.

Implementation of the invention eliminates the need for the user of the entertainment system to understand the specific requirements for connecting various consumer electronic devices together. Instead, the user must merely identify on the consumer electronic device whether an RCA-type connector or an S-video connector is required for connection. The identification is facilitated by the appearance of the two types of connectors being different. If an S-video end is required, the S-video male connector is inserted into the S-video female connector of the consumer electronic device. If an RCA-type connector is required, the S-video male connector is mated with the S-video end of the adapter, and the RCA male end of the adapter is connected to the RCA female connector of the consumer electronic device.

1 In the embodiment of the invention referred to above, the mini plug of the connector
2 system has the same size shaft as a standard mini plug, but with an increased number of
3 contact points. A receptacle within an electronic device mates with the mini plug. The
4 receptacle contains at least one contact point that is used for ground sensing in order for the
5 accompanying software to detect which devices are connected in the entertainment system.

6 Additional features and advantages of the invention will be set forth in the
7 description that follows, and in part will be obvious from the description, or may be learned
8 by the practice of the invention. The features and advantages of the invention may be
9 realized and obtained by the means and combinations particularly pointed out in the
10 appended claims. These and other features of the present invention will become more fully
11 apparent from the following description and appended claims, or may be learned by the
12 practice of the invention as set forth hereinafter.

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BRIEF DESCRIPTION OF THE DRAWINGS

In order that the manner in which the above recited and other advantages and objects of the invention are obtained, a more particular description of the invention briefly described above will be rendered by reference to specific embodiments thereof that are illustrated in the appended drawings. Understanding that these drawings depict only typical embodiments of the invention and are not therefore to be considered limiting of its scope, the invention will be described and explained with additional specificity and detail through the use of the accompanying drawings in which:

Figure 1 is an illustration of an embodiment having a cable with a left audio connector, a right audio connector, a male S-video connector, a mini plug and an adapter that has a male RCA end and a female S-video end.

Figure 2 is an illustration of an embodiment of an adapter that has a male RCA end and a female S-video end.

Figure 3 is an illustration of an embodiment where the male S-video connector attached to the cable is mated with the female S-video end of the adapter, thereby effectively creating a male RCA connector.

Figure 4 is an illustration of a mini plug that has the same size shaft as a standard mini plug, but with an increased number of contact points.

Figure 5 is an illustration of a stacked dual receptacle that can be embedded in a consumer electronic device for mating with a mini plug.

Figure 6 is a schematic diagram demonstrating the mating of a receptacle, embedded in a consumer electronic device, with a mini plug, and further illustrates an embodiment where components of a central electronic device are used for sensing whether or not a proper

1 connection has been made, the cable type connected thereto, and the format of the electrical
2 signaling.

3 Figure 7 is a schematic diagram that illustrates an example of an environment
4 wherein an embodiment of the present invention can be implemented, namely a home
5 entertainment system in a hub and spoke configuration.

6 Figure 8 illustrates a back panel of a central electronic device according to one
7 embodiment of the invention, illustrating a plurality of identical, interchangeable jacks.

8 Figure 9 is a schematic diagram depicting a home entertainment system in a hub and
9 spoke configuration, illustrating the use of jacks for sending signals into and out of a central
10 electronic device.

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DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention relates to systems and methods for interconnecting consumer electronic devices in a home entertainment system to allow for switching between composite video and S-video formats. The invention further extends to systems and methods that support left audio, right audio, and can be selectively adapted to support either composite video or S-video. According to one embodiment of the invention, a mini plug is included that has the same size shaft as a standard mini plug, but with an increased number of contact points. According to another embodiment, detection takes place as to which devices are connected in the home entertainment system. The systems and methods provide increased ease and flexibility, and improved interoperability of components in the home entertainment system.

The invention will be described through the use of diagrams to illustrate either the structure or processing of embodiments used to implement the systems and methods of the present invention. Using the diagrams in this manner to present the invention should not be construed as limiting its scope.

The invention will be described in reference to consumer electronic devices included in a home entertainment system. In this context, "consumer electronic device" or "electronic device" is used to refer to any number or type of various consumer electronic devices that provide audio output, video output, or information services or can be connected to a television set. Such devices include, but are not limited to, cable boxes, satellite receivers, video cassette recorders (VCRs), video game consoles, video disk players, home theater equipment, home stereo equipment, Internet terminals, personal computers, and television sets. "Home entertainment system" refers to a system that includes one or more

1 consumer electronic devices and provides audio and/or video output to a user and is not
2 limited to those that are used in residential buildings.

3
4 **I. Connector Systems**

5 Referring now to Figure 1, an embodiment is depicted generally as connector system
6 100 that includes mini plug 110 connected to cable 120, which is in turn connected to RCA
7 connector 130, RCA connector 140, S-video connector 150, and adapter 160. Strain relief
8 structure 170 is included to provide support to cable 120 and to prevent shearing or other
9 deterioration of the electrical conductors within cable 120. In one embodiment, male mini
10 plug shaft 112 of mini plug 110 has the same length and diameter as a standard male mini
11 plug shaft. However, male mini plug shaft 112 has an increased number of contact points to
12 enable the passage of either composite or S-video signals, as will be further explained
13 below.

14 Cable 120 is any type of means for conducting electrical signals capable of being
15 attached to connectors such as a mini plug, an RCA connector, and/or an S-video connector,
16 thereby allowing audio and/or video signals to be conducted through the cable. By way of
17 example, such means for conducting can include any suitable metallic conductors such as
18 copper, nickel, silver, and so forth, surrounded by an insulator to allow for directed
19 transmission of a signal.

20 RCA connectors 130 and 140 respectively support left audio and right audio when an
21 RCA format is employed, as shall be further explained below. Male shafts 132 and 142 can
22 be mated with female RCA connectors of an consumer electronic device or another cable
23 system to provide a coupling with connector system 100 whereby a signal can be transmitted
24 through the coupling.

1 S-video connector 150 supports audio and video signals when an S-video format is
2 employed. Male S-video connector 152 can be mated with a female S-video connector of a
3 consumer electronic device or another cable system to provide a coupling with connector
4 system 100 whereby audio and video signals can be transmitted through the coupling.

5 Adapter 160 contains male RCA end 162 and female S-video end 164 and can be
6 mated with S-video connector 150 to provide an equivalent RCA connector to support video
7 signals when an RCA video format is employed. In one embodiment, adapter 160 is made
8 available for mating with male S-video connector 152 by being attached to S-video
9 connector 150 or cable 120. In one embodiment, and as illustrated in Figure 1, means 166
10 for attaching adapter 160 to S-video connector 150 is employed. By way of example, means
11 166 can be any means for attaching adapter 160 to S-video connector 150 in order that
12 adapter 160 is available to be coupled with S-video connector 150 when a composite signal
13 is employed. By way of example, Figure 1 illustrates attaching means 166 as a plastic
14 thread. No signal is required to be transmitted through attaching means 166.

15 As mentioned above, connector system 100 is capable of conducting audio signals
16 and video signals between electronic devices, regardless of whether the signals are in a
17 composite or S-video format. Connector system 100 can also be used as a means for
18 conducting only audio signals or only video signals. As explained above, the video signal
19 can be in either a composite or S-video format.

20 Referring to Figure 2, adapter 160 is illustrated to highlight female S-video end 164
21 having sockets 210 whereby corresponding pins on male S-video connector 152 are inserted
22 to provide a connection between S-video connector 150 and adapter 160. The four sockets
23 210 and corresponding four pins on male S-video connector 152 are dedicated for the
24 transmission of left audio, right audio, chroma, and luma. In order to assist a user in making

1 a proper connection, in one embodiment symbols are placed on S-video connector 150 and
2 adapter 160 in such a way as to allow for a proper alignment in the connection between S-
3 video connector 150 and adapter 160. For example, adapter 160 has formed thereon an
4 arrow 200 that matches a corresponding arrow 300 on S-video connector 150 as illustrated
5 in Figure 3 to assist the user in making a proper connection.

6 The combination of S-video connector 150 and adapter 160 provides an equivalent
7 male RCA connector to support video signals when an RCA video format is employed.
8 Upon the connection of S-video connector 150 with adapter 160, male RCA end 162 can be
9 coupled with a female RCA connector of a consumer electronic device or another cable
10 system so as to enable composite video signals to be transmitted through cable 120.

11 A consumer electronic device connected to mini plug 110 can be notified that
12 adapter 160 is coupled with S-video connector 150 to allow for the transmission of a
13 composite signal. By way of example, differential amplifiers or impedance sensors can
14 detect which of the male pins on male S-video connector 150 are employed for transmitting
15 a signal, can determine if the signal is in a composite or S-video format, and thus whether or
16 not adapter 160 is coupled with S-video connector 150. The result obtained can then be
17 transmitted to the consumer electronic device that is connected to mini plug 110 to notify the
18 device as to whether or not adapter 160 is being employed.

19 When S-video connector 150 is mated with adapter 160 in preparation for
20 conducting a composite signal, a two-pin shortage is established at the S-video connector.
21 Based on the presence or absence of this two-pin shortage, the electronic device coupled to
22 mini plug 110 can determine whether connector system 100 has been adapted to conduct
23 composite or S-video signals. Based on this determination, the electronic device can infer
24 which type of signal the electronic device connected to the opposite end of connector system

1 In view of the foregoing, adapter 160, S-video connector 150, and RCA connectors
2 130 and 140 represent one example of structure that corresponds to means for selectively
3 adapting the interconnection system for use with either a composite video signal format or
4 an S-video signal format. In general, the means for selectively adapting the interconnection
5 system in this way extends to any other connectors that are attached to the ends of the
6 plurality of electrical conductors in cable 120 opposite mini plug 110 in a manner such that
7 i) the single cable system can be used for both composite and S-video signals and ii) at least
8 some of the individual electrical conductors can be used at different times with electrical
9 signals formatted according to the composite signal format and the S-video signal format.

10 Figure 4 is an illustration of mini plug 110 having mini plug shaft 112 that provides
11 an increased number of contact points on the same size shaft as a standard mini plug shaft.
12 In one embodiment, mini plug shaft 112 includes five contact points 410a-e. The five
13 contact points are for left audio, right audio, video chroma, video luma, and ground. In one
14 embodiment, the end contact point 410a is used for left audio and the third contact point
15 410c is used for right audio. When S-video signaling is being transmitted, all five contact
16 points 410a-e are in use. When composite signaling is being transmitted, the contact points
17 for left audio, right audio, and ground and one video contact point are used since adapter
18 160 combines the video chroma and luma for composite signaling. Therefore, a single
19 connector, such as mini plug 110, can be used for left and right audio and composite or S-
20 video signals.

21 Figure 5 illustrates receptacle 500 that can be embedded in a consumer electronic
22 device for mating with mini plug 110. In one embodiment, and as illustrated in Figure 5,
23 receptacle 500 is a dual stacked receptacle capable of supporting both upper and lower
24 applications. As such, one of sockets 510 or 520 is dedicated for signals transmitted into

1 receptacle 500 and the other socket is dedicated for signals transmitted out of receptacle 500.
2 Moreover, receptacle 500 is said to be a dual stacked receptacle because of the presence of
3 adjacent sockets 510 and 520. Mini plug 110 can be mated with either socket 510 or 520.

4 In one embodiment, receptacle 500 provides a contact point for connection with each
5 of the five contact points 410a-e of Figure 4, and one or more contact points for ground
6 sensing. The contact points used for ground sensing recognize a physical displacement as a
7 result of inserting mini plug 110, and notify a software component that mini plug 110 is
8 inserted. Thus, the accompanying software can detect which devices are connected in a
9 home entertainment system, as shall be further explained below. Pins 530 provide an
10 electrical contact between receptacle 500 and the electrical components of the consumer
11 electronic device of which receptacle 800 is embedded.
12

13 **II. Determination of Connection Properties**

14 Referring now to Figure 6, an embodiment is illustrated in which receptacle 500 can
15 be embedded into a consumer electronic device and made available for mating with mini
16 plug 110. In this embodiment receptacle 500 is embedded in central electronic device 610.
17 In the embodiment of Figure 6, central electronic device 610 includes hardware and/or
18 computer-executable instructions for determining that a consumer electronic device is
19 connected, the type of device that is connected, and the type of signal format that is being
20 employed in the transmission. More specifically, central electronic device 610 includes
21 cable type sensor 620, signal format module 630 and ground sensor 640.

22 When a contact point of receptacle 500 that is dedicated for ground sensing comes in
23 contact with male mini plug shaft 112, ground sensor 640 is notified of the connection of
24 mini plug 110 with central electronic device 610. As such, ground sensor 640 is used to

1 recognize whether a proper connection has taken place between mini plug 110 and
2 receptacle 500. Furthermore, ground sensor 640 can notify a user as to whether the
3 connection is or is not proper. By way of example, the notification can take place either by
4 utilizing hardware and/or software to illuminate a light, send an audio message or flash a
5 message on a monitor notifying that the connection is proper, or in any other desired
6 manner. The computer-executable instructions used to notify the user of a proper
7 connection can be executed by a processor and can be contained in ROM, flash memory,
8 and/or RAM.

9 In one embodiment, when the user connects mini plug 110 to receptacle 500, cable
10 type sensor 620 determines whether cable 120 is an audio-video (AV) cable or an audio-
11 only cable. For example, if cable 120 is connected to a digital satellite system (DSS)
12 receiver, cable type sensor 620 determines that cable 120 is an AV cable. Cable type sensor
13 630 then determines whether the cable is an input or output cable with respect to the
14 consumer electronic device by determining whether there is an audio or video signal on the
15 cable. For example, if the user has connected a DSS receiver to central electronic device
16 610, cable type sensor 620 will determine that cable 120 is an AV output cable associated
17 with a consumer electronic device.

18 When cable type sensor 620 has characterized cable 120 as AV or audio-only and as
19 an input or output cable, the cable type sensor may need additional information to identify
20 the consumer electronic device associated with cable 120. If so, central electronic device
21 610 can prompt the user to input the type of consumer electronic device. The prompt can
22 be, for example, the display of a question or menu choice on a television set connected to
23 central electronic device 610. Although identifying the consumer electronic device may
24 require some user input, it does not require the user to understand whether cable 120 is AV

1 or audio-only or whether it is an input or output cable. In view of the foregoing, cable type
2 sensor 620 represents one example of means for identifying the type of signals that are
3 compatible with the consumer electronic devices connected to central electronic device 610.

4 In some instances, cable type sensor 620 can also deduce the identity of the
5 consumer electronic device connected to cable 120 using the signals carried on cable 120
6 and conductivity properties of the cable. For instance, cable type sensor 620 can determine
7 whether the cable conducts only in one direction or measure the impedance of the jack to
8 determine if the cable is connected to a microphone or is an audio connector.

9 Cable type sensor 620 can also determine whether the connected cable carries a
10 composite or S-video signal. As mentioned above, cable 120 is supplemented with S-video-
11 to-RCA video adapter 160, illustrated in Figures 1-3, which allows cable 120 to be used with
12 televisions or other consumer electronic devices having either a composite or S-video
13 format. Notably, mini plug 110 of cable 120 that connects to the central electronic device
14 610 of Figure 6 is the same whether cable 120 is used with S-video or composite signals.
15 Thus, the user inserts mini plug 110 into receptacle 500 of central electronic device 610 and
16 when the consumer electronic device to be connected does not have an S-video connector, or
17 when the user desires to use the RCA video input, adapter 160 is coupled to the end of S-
18 video connector 150, as illustrated above in Figure 3. When cable 120 is instead to be used
19 with an S-video format, adapter 160 remains unconnected to S-video connector 150. In this
20 case, S-video connector 150 is coupled with the corresponding S-video connector of the
21 television.

22 Connector system 100 can therefore be used to connect a consumer electronic device
23 to a home entertainment system without the user understanding the significance of the
24 difference between S-video and RCA connections. The user merely selects a receptacle on

1 central electronic device 610 and S-video connector 150 with or without adapter 160. Cable
2 type sensor 620 can determine whether cable 120 is being used with or with out adapter 160
3 through the use of a two pin shortage, as explained above, and can determine the type of
4 signal that is transmitted through cable 120 and thus how cable 120 is being used. If adapter
5 160 is used, cable type sensor 620 concludes that cable 120 is being used as an RCA cable.
6 Otherwise, cable type sensor 620 concludes that cable 120 is being used as an S-video cable.
7

8 **III. Exemplary Home Entertainment System Environment**

9 The connector systems of the invention can be used to conveniently interconnect
10 electronic devices arranged in the hub and spoke configuration. The connector systems can
11 also be used to interconnect electronic devices having any other desired topology. By way
12 of example, the connector system of the invention can be used to interconnect one consumer
13 electronic device, such as a video camera, with another consumer electronic device, such as
14 a television. In this example, receptacle 500 can be embedded in the video camera for
15 connecting to mini plug 110 and RCA connector 130, and RCA connector 140, and adapter
16 160 coupled with S-video connector 150 can be connected to the television when a
17 composite signal format is employed or S-video connector 150 can be connected to the
18 television when an S-video signal format is used.

19 Figures 7-9 will be used to illustrate an environment in which an embodiment of the
20 present invention is used to conveniently interconnect electronic devices of home
21 entertainment systems that are arranged in a hub and spoke configuration. The environment
22 is further detailed in U.S. Patent Application Serial No. 09/244,222, entitled "System and
23 Method for Interconnecting and Using Components of Home Entertainment System,"
24 incorporated herein by reference.

1 jacks 810 are interchangeable, and the user generally does not need to know any special
2 connection techniques for the various consumer electronic devices other than connecting
3 them to any desired jack 810.

4 Unlike the separate RCA-type, S-video, and other connectors typically found in
5 conventional electronic devices, jacks 810 can be used to transmit or receive any of a variety
6 of video, audio, or data signals from the consumer electronic devices. For instance, any
7 particular jack 810 can function with stereo or mono audio signals, S-video signals, or RCA
8 signals. This capability enables central electronic device 610 to conveniently interconnect
9 cable boxes, satellite receivers, video tape recorders, video game consoles, video disk
10 players, home theater equipment, home stereo equipment, television sets, and other
11 consumer electronic devices without the user having to understand the different cables and
12 connection techniques that have been conventionally used in home entertainment systems.

13 The number of jacks 810 can be enough to provide input to or output from each of
14 the other consumer electronic devices included in the home entertainment system. While
15 ten to twelve jacks are often enough to support a reasonably complex home entertainment
16 system, the number may be greater or smaller depending on the number of consumer
17 electronic devices desired as components of a home entertainment system.

18 The connection of a new electronic device to central electronic device 610 merely
19 requires the user to connect the new device to one of the identical jacks 810 of Figure 8.
20 The task of connecting a new consumer electronic device to central electronic device 610 is
21 basically the same, regardless of whether the new consumer electronic device is a video
22 game console, stereo equipment, digital versatile disk players (DVDs) or the like. Thus, the
23 user generally does not need to know any special requirements for connecting the new
24

1 consumer electronic device. Furthermore, the existing devices, previously connected in the
2 home entertainment system, do not need to be repositioned, reconfigured, or removed.

3 Central electronic device 610 further includes AC power input 820, phone jack 830
4 (to support the optional Internet access or other information services), and optionally
5 universal serial bus (USB) port 840 and digital terrestrial antenna 850. Coaxial cable input
6 860 receives cable television signals from a cable provider.

7 Referring now to Figure 9, a home entertainment system, illustrated generally as
8 home entertainment system 900, includes central electronic device 610 connected to cable
9 box 720, VCR 730, television 740, cable jack 770 and also connected to DSS 910, DVD
10 920, stereo 930, and video game 940. The electronic devices are connected to central
11 electronic device 610 through jacks 810. As illustrated in Figure 9, some of jacks 810 are
12 used to send signals into central electronic device 610 while other jacks 810 are used to send
13 signals out of central electronic device 610. In one embodiment, jacks 810 are labeled as
14 "in" or "out" in order to facilitate the connection of the consumer devices. In another
15 embodiment, intelligent switching in the software of central electronic device 610 takes
16 place to identify whether a signal is sent in or out of a particular jack, as was explained
17 above in correlation with Figure 6.

18 As explained above, the present invention relates to systems and methods for use in
19 inter-device connectivity and allow for switching between composite video and S-video
20 formats. The present invention may be embodied in other specific forms without departing
21 from its spirit or essential characteristics. The described embodiments are to be considered
22 in all respects only as illustrative and not restrictive. The scope of the invention is,
23 therefore, indicated by the appended claims rather than by the foregoing description. All
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